

ADVANCED
WINDOWS

Master Windows XP's hard disk tools

Looking after your hard disk can speed up your PC and greatly reduce the chances of data loss. **Peter Wood** shows you what needs to be done to keep everything in full working order

Hard disk maintenance isn't a thrilling topic. However, as anyone who has accidentally deleted a data partition will attest, at that point it's a white-knuckle ride. Almost every PC enthusiast has had that kind of moment: one minute you're doing a routine backup, the next you're wondering why there's blank space where three-and-a-half years' worth of files used to be. In this month's *Advanced Windows*, we show you how to use the maintenance and partitioning tools built into Windows to get the most from your hard disk, without any tears.

Almost all the advice given in this article, except that which involves third-party software, is applicable only to PCs running Windows 2000 and Windows XP Professional Edition.

THE HARD FACTS

Inside a hard drive are a number of disks, called platters, which are covered in a ferrous coating. The surface of each disk is divided into concentric circles, called tracks. Each track is further divided into a number of sectors. Inside each sector are millions of 'points', each of which can be given either a north or south polarisation.

Depending on how each point is polarised, it can represent a binary 1 or a binary 0, the basic units of any computer data. Information is written to and read from the disk by a number of read/write heads, one for each side of every platter. These are mounted on motorised arms that move them back and forth across the platter's surface, searching for the exact bits of data they need.

In order for the hard disk to find the right bits of data among the billions of polarised points on each platter, it needs an index to which it can refer. Your operating system provides this index. When you install a new hard disk, your operating system will ask you to format it. When you do this, a file-allocation table and directory system are created. Together they record where each bit of information in every file is stored. The two most common disk formats for Windows are FAT32 and NTFS. See the 'Weighty issues' box below for more information.

UNDERSTANDING PARTITIONS

The first sector on your hard disk contains the Master Boot Record (MBR). The MBR contains two entries without which your PC cannot function. These are the Master Boot Code, a small program that starts the boot process (assuming that this is the disk on which you have your operating system), and the Master Partition Table. As its name suggests, the Master Partition Table contains information about all the partitions on your disk. It tells your operating system (and any other program capable of reading the MBR) the exact points on the disk where each partition starts and finishes.

The Master Partition Table has a 64-byte capacity and, as each partition record is 16 bytes long, users are limited to four partitions per disk. This was more than enough a few years ago, but these days you may need more. To get around the four-partition limitation,

INTRODUCTION

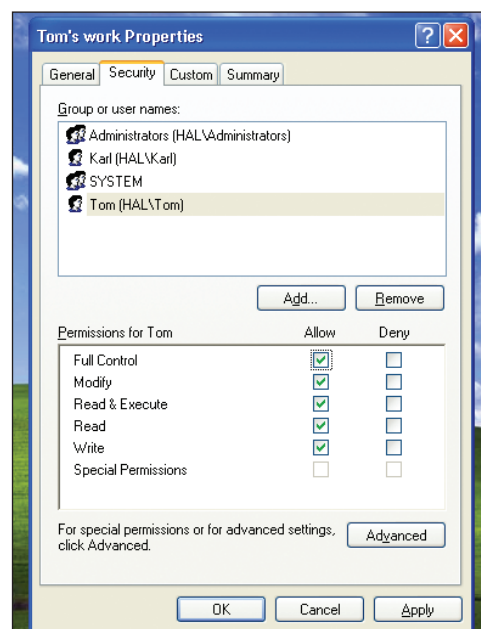
Set up your hard disk properly and you will greatly increase the chances of your data surviving a serious system crash. While the basic hard disk partitioning and maintenance tools built into Windows can be tricky to use and don't provide every function you might need, Windows comes with many more hard disk tools than most people realise.

Users of Windows XP Professional Edition can create certain types of RAID array using only the software provided with their operating system. If Windows' own tools are flexible enough to do what you need, there's a good chance you can sort out a decent arrangement without spending a penny. With just a little know-how, even inexperienced users can easily and safely perform advanced partitioning operations on their hard disk without any additional expense.

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▲ When you format a disk using the NTFS file system, Windows 2000 and Windows XP make many advanced security features available, enabling you to specify who can access individual files and what they can do with them

Weighty issues Working with FAT32 and NTFS

FAT32 is a 32-bit version of the original FAT file system as used by the DOS operating system since the 1980s. It is supported by all Windows operating systems as well as by others, including Mac OS. This is why removable storage tends to be formatted with FAT32.

The NT file system (NTFS) enjoys a number of advantages over FAT32. The Master File Table (the equivalent to FAT32's file-allocation table) doesn't just contain information about where the bits of each file can be found. It also records other attributes, such as which users are allowed to access each file. This means that security on a system formatted with NTFS can be much tighter than on one formatted with FAT32.

The maximum size of files with NTFS is limited only by the size of your hard disk, whereas FAT32 supports files of up to 4GB only. This never used to be a problem but, with the growing popularity of video editing, large files are more common and FAT32 users are increasingly likely to run into problems.

Split level Free partitioning tools

As we've already mentioned, the disk-partitioning facilities built into Windows are very limited. If you're prepared to be a bit adventurous, however, it is possible to get a good partition editor for free that looks and works just like commercial programs. Download the ISO image available from the Knoppix website (www.knoppix.org) and use your CD-burning software to burn this to a CD. Reboot your PC with that CD in your

optical drive and ensure that your PC's BIOS is set to boot from this device.

Your PC will boot from the CD into Knoppix Linux, which looks like Windows. From the Start menu, go to System and choose the program QTParted. This is a disk-partitioning program that looks and works very much like Symantec's popular Partition Magic utility, a program that would set you back around £40.

modern hard disks also support extended partitions, which are partitions that can contain further so-called logical drives. This allows users to have more than four partitions on a disk.

When using disk tools you will encounter the term 'active partition'. The active partition is the partition from which the MBR boots your PC, which is the one on which your operating system is installed. Only partitions on the primary hard disk can be set to be active.

DISK MANAGEMENT

Most hard disk maintenance tasks in Windows XP are carried out using something called the Disk Management snap-in, which is part of the Microsoft Management Console (MMC). To open the MMC, right-click on My Computer and choose Manage from the menu.

When you install a new hard disk, you may be unpleasantly surprised to discover that it doesn't appear in My Computer. This is because it hasn't been formatted yet. To fix this problem, open the MMC and click on Disk Management. In the Disk Management snap-in, you will see a visual representation of your hard disks. The new disk will appear with the label 'unallocated space'. Right-click on the new disk, click Format and complete the formatting wizard. Once the wizard is finished, the disk will be accessible to Windows.

The first time you format a disk, Windows will ask you how large you want the partition to be. If you want to have more than one partition on your hard disk, make sure you specify a partition size that's less than the total available space. You should then be able to run the wizard again to create your second partition (and any further partitions) in the remaining unallocated space. If you create a single partition at this point and later decide you would like more than

one partition on your hard disk, you will need third-party software to resize it to make space for the new one.

Windows is not very good at moving or resizing existing partitions. The most you can do is enlarge an existing partition using the command-line utility diskpart. To find out how this is done, go to <http://support.microsoft.com> and search for 'Windows XP diskpart extend volume'. You will find several articles that explain the process.

DYNAMIC DISKS

So far, we have covered what Microsoft refers to as basic disks. These are disks that have been formatted and partitioned in the conventional fashion using the Master Partition Table in the MBR to list their partitions. But there is an alternative, called dynamic disks. Instead of an entry for each partition on the disk, the MBR of a dynamic disk contains a single entry, the value of which indicates simply that the disk is a dynamic disk. For detailed information on how the disk is partitioned, the operating system refers to a database, called the LDM Metadata partition, which is stored at the end of the hard disk.

Only Windows 2000, Windows XP Professional Edition and Windows Server 2003 can correctly interpret the entry in the MBR that refers to the LDM Metadata partition. Other operating systems see only a disk that is formatted with an incompatible file system. Older disk-partitioning programs can see that the disk is formatted, but they can't work with it. Newer partitioning programs recognise that the volume is a dynamic disk, but even they can't make changes.

You can do several things with a dynamic disk that you cannot do with a basic disk. You can enlarge partitions on a dynamic disk simply by right-clicking the partition and choosing Extend Volume. A dynamic disk can also accommodate more than four partitions without you having to create an extended partition to house further logical drives. You can span a volume across two disks, which is useful if you need to store very large files such as raw video footage.

You can also stripe a pair of hard disks. In a striped pair of disks, two disks are treated as a single partition, just as in a spanned volume. But rather than simply saving files to the first available space, each file



▲ Acronis Disk Director recognises the dynamic disk, but still can't work with it. Older partitioning utilities would not know what the dynamic disk was

is deliberately split between the two disks. This accelerates the read and write speeds because each hard disk has to deal with only roughly half the data it would normally process.

You don't have to use identical disks in either a spanned or a striped array. A spanned volume will use all the space available to it on both disks. If you try to stripe two non-identical volumes, Windows creates a partition on the larger disk that is exactly the same size as the smaller disk. You can create a further partition in the space remaining on the larger disk so you don't waste any resources. It won't benefit from the extra speed of the striped partition, though.

Sadly, only Microsoft server operating systems support the other common way of storing data across an array of hard disks, which is known as mirroring. When you mirror a pair of hard disks, everything you save to the first disk is automatically copied to the second. Even if one disk fails completely, you will be able to get back up and running fast using the remaining disk. Had it been made more widely available, this useful feature might have persuaded more people to use dynamic disks.

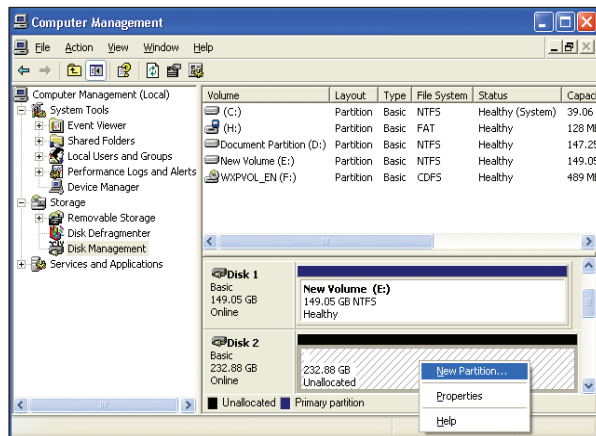
To find out how to convert a basic disk to a dynamic one, see opposite. Before you do so, it's important to be aware of some significant limitations suffered by dynamic disks. For a start, while extending partitions on a dynamic disk into unallocated space may be relatively easy, other partitioning operations are not. Windows doesn't make it easy to move or resize partitions on a dynamic disk, and commercial partitioning software won't work with dynamic disks either.

The only way to reallocate space on a dynamic disk is to move your files off it to a secure external location, reformat the disk and move the files back afterwards. Likewise, if you wish to turn a dynamic disk back into a basic one, you need to move your files off it first because this process also wipes all the data on the disk. USB and FireWire disks cannot be made dynamic.

CONVERTING DYNAMIC TO BASIC

Usually, the only way to turn a dynamic disk back into a basic disk is to delete any volumes that you have created on it. Once you've done this, right-click the disk label as you did before and choose Convert to Basic Disk. Before you do this, you must move any data you do not want to lose to another hard disk.

We tried a number of methods for getting around this problem. The only one that worked was to delete the volume on the dynamic disk, convert the dynamic disk back into a basic disk and then use the undelete tool in a commercial disk-partitioning utility. This is not an ideal workaround when handling important data.



▲ Using the Disk Management snap-in you can format your disk, create new partitions and delete partitions. Apart from that, the snap-in is fairly limited in the features it has to offer for formatting basic disks

MANAGING REMOVABLE STORAGE

Another area of disk management that many don't understand is the way in which Windows handles removable storage. This is worth knowing because working in the correct way with removable disks reduces the risk of losing data and may even prolong the life of your hardware.

By default, when you copy files to a removable storage device such as a flash drive, Windows uses write caching. Instead of writing each file to the device as that file is copied, Windows saves the files in memory and completes the transfer only when it has enough data queued to make the operation worthwhile. In this scenario, if you remove the device without warning the operating system first, your data may not be transferred to your removable storage device.

To unplug a removable storage device safely, you should first click on the Remove Hardware icon in the Notification area of the taskbar and choose the device that you intend to remove. Windows will then copy any outstanding files and tell you when it is safe to remove the device.

Alternatively, you could disable write caching. Right-click My Computer and select Properties from the Context menu. From the Hardware tab click Device Manager and click the '+' sign next to the Disk drives category. Your removable storage device will be listed under this heading, along with your system's hard disks. Right-click the removable storage device and pick Properties from the Context menu. On the Policies tab that appears, select the 'Optimize for quick removal' setting. Now, when you use this removable storage device with your PC, write caching will

be disabled and you won't need to go through the tedious hardware-removal procedure.

THE GOLDEN RULE

Using the techniques demonstrated here will enable you to manage and maintain your hard disk effectively to keep your system running smoothly and avoid data loss. However, as far as protecting data is concerned, these techniques only supplement a well-organised backup regime.

Windows XP has its own backup tool, found on the Start menu under Accessories. There are also many easy-to-use and effective commercial disk-imaging programs available, and we've reviewed nine backup packages in *Labs*, page 121. If you plan to repartition your hard disk or do any kind of hard disk maintenance, back up important data to a secure location first. **CS**

HOW TO... Create a dynamic disk

In this walkthrough, we'll show you how to create a single volume spanned over two dynamic disks. To do this, you'll need to be running Windows 2000, Windows XP Professional or Windows Server 2003.

1 Open the Microsoft Management Console by right-clicking on My Computer and choosing Manage. In the MMC, double-click on Disk Management. This will open the Disk Management snap-in. You should see a graphical representation of the hard disks in your system, including the unformatted disks.

2 Select the first basic disk that you wish to turn into a dynamic disk and right-click on the grey area where you see the disk's number (Disk 1, for instance) displayed. Choose the option Convert to Dynamic Disk. Follow the wizard routine to convert the basic disk into a dynamic one. Do the same for the second disk you wish to convert.

3 Right-click on one of the disks in the space marked Unallocated. Choose New Volume from the context menu. You will be offered three choices. In this case, we are going

to create a spanned volume. If you had only one disk, you would create a simple volume. For maximum transfer rates, you would create a striped volume.

4 Next, choose the other dynamic hard disk and add it to your list of volumes to be spanned. It's best to tick the Quick format option, otherwise Windows will take a long time to build the NTFS file system on your new volume. When formatting is over, your new spanned volume will appear as one large single drive in My Computer.

